

1 **A METHOD FOR LINKING NON-OBJECT ORIENTED DATA**
2 **MODELS TO OBJECT ORIENTED DATA MODELS USING A**
3 **TECHNIQUE TO ACHIEVE ZERO-SIZE OBJECT MAPPING**

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5 **TECHNICAL FIELD**

6 This invention relates to object mapping. In particular, the invention relates to a technique
7 for retrieving non-object oriented data from within an object oriented model using zero-size object
8 mapping.

9

10 **BACKGROUND**

11 The complexity of designing a VLSI chip has produced numerous CAD automation tools
12 that help designers with synthesis and abstraction across behavioral, structural and layout domains.
13 Central to all tools lies an information model that describes how information is organized. The
14 information model is an abstraction of a data model, which in turn describes implementation details.

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16 There are multiple CAD infrastructures in use. Legacy infrastructures have been developed
17 over many years and thus there has been significant investment by companies in terms of designs,
18 engines, or programs that use this middleware. Emerging CAD infrastructures use object oriented
19 models. The present invention attempts to map an object oriented model into a legacy type. To
20 access the data in the legacy model, the designers do not want to copy all the data onto the object
21 oriented model because this would be very expensive. Thus there is a need for a method of
22 overlaid the memory that the legacy model contains with the new object oriented model.

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24 As object oriented methodologies become more pervasive, there has been an increase in
25 object oriented based data models for CAD infrastructures. The need to support legacy data
26 models that are structural in nature forces designers to look for alternatives that adopt new

1 technologies and preserve existing investments. Unfortunately, these tasks are at odds with each
2 other, requiring either full adoption, or the improvement of legacy data models.

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4 Currently, there are several techniques that use zero-size objects to achieve a mapping
5 between non-object oriented data models and object oriented based models. Zero-size object
6 mapping is a form of overlaying existing memory occupied by another object. Some prior coding
7 techniques to achieve zero-size object mapping are reinterpret casts and placement of objects.

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10 Reinterpret casts is a form of explicit type conversion that can also be used to overlay
11 existing memory. A *reinterpret_cast* operation converts between types of objects even when
12 objects are totally unrelated. This can cause serious problems if the memory images of the types
13 are different. In addition, this technique of overlay memory is also non-portable. In reinterpret cast,
14 non-portable means this methodology would not work the same way as on a machine on which the
15 code was compiled.

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17 The placement of objects technique is a method that overloads the new operator. This
18 technique specifically forces the new operator to place the new object at a specific memory location
19 rather than using the heap and free store method of the reinterpret cast.

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21 Additional alternatives to these two methodologies include keeping two separate data
22 models that must be kept in sync at all times. However, this incurs a lot of memory usage. In
23 addition, the designer can choose to either keep and improve the legacy system or migrate to a
24 brand new CAD interface. However, this would be both time consuming and expensive since
25 additional memory would be required.

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27 True interoperability between CAD infrastructures is a difficult challenge, and no business
28 can afford to choose a new system that ignores the investments on non-object oriented

1 infrastructures. The present invention is one that can be used as an evolutionary approach to help
2 drive new technologies while continuing to use existing legacy databases.
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4 **SUMMARY**

5 The present invention solves the problem of merging a non-object oriented data model, with
6 a new object oriented data model. Since both models are used, the benefits of an integrated
7 information model will greatly facilitate the development of new tools. Using the present invention to
8 achieve zero-sized objects to merge the two data models allows the designers of two CAD
9 infrastructures a portal via which they can now potentially have bi-directional access between
10 models. In addition, even if designers use disparate APIs to access data, their information is
11 automatically synchronized because they refer to the same memory area.

12 **DESCRIPTION OF THE DRAWINGS**

13 The detailed description will refer to the following figures in which like numeral refer to like
14 items, and in which:

15 Figure 1 is a block diagram of a computer system with a preferred embodiment of the
16 present invention;

17 Figure 2 is a diagram illustrating mapping data between two different models; and

18 Figure 3 is a flow chart illustrating the steps to creating a zero-size object mapping.

19 **DETAILED DESCRIPTION**

20 **Figure 1** is a block diagram of a computer system 100. The computer system 100
21 comprises a display device 105, an input device 110, and a processor 115 connected to a main
22 memory 120. The system 100 components are interconnected through the use of a system bus
23 125. A mass storage device 130, such as a floppy disk drive, is connected to the computer system
24 100. The computer system 100 may store data to and read data from the disk 130.
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1 The main memory 120 contains non-object oriented data 135 and a mapping program
2 140 in accordance with the preferred embodiment. The non-object oriented data 135 could be
3 stored within, for example, C-structures. The mapping program 140 will map an object to an image
4 in memory 120 occupied by the non-object oriented data 135. By mapping directly into the
5 memory 120 occupied by the non-object oriented data, no new or additional memory allocation is
6 required. This is known as zero-size object mapping. Zero-size object mapping is a form of
7 overlying existing memory occupied by another object.

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9 Before discussing how the mapping occurs between a object oriented model and a non-
10 object oriented model, a few key terms will be defined as used with conventional object oriented
11 programming.

12
13 One concept in object oriented programming is class. A class is a template that defines a
14 type of object. A programmer may define a class by having a section of code known as a class
15 definition. An object is an instance of a class. An object may include attributes or data as well as
16 functions or methods. The class definition specifies the attributes and methods. The attributes are
17 represented in an object by the values of instance variables.

18
19 Another concept in object oriented programming is inheritance. Inheritance is the ability to
20 derive a new class from one or more existing classes. The new class, known as a subclass, may
21 inherit or incorporate all properties of a base class, including its attributes and its methods.

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23 Another concept in object oriented programming is encapsulation. A class definition may
24 specify that the data of objects of that class is private and cannot be retrieved by another object.
25 Objects must communicate with one another via their object interfaces, and the data may be
26 encapsulated by limiting access to it through the object interface.

1 **Figure 2** illustrates how the data is mapped. Initially, a non-object oriented system 200 has
2 some memory representation of a C-structure. The structure definition contains information about
3 the data. In the object oriented system, instead of creating another memory for the data located in
4 the non-object oriented system 200, the object oriented system maps onto the non-object oriented
5 memory.

6
7 When a programmer creates an instance of that structure in memory, the programmer has to
8 allocate memory to hold that information. In order to map, the object oriented system inherits the
9 non-object oriented data that came from the C structure. Inheritance allows the programmer to
10 access the non-object oriented structure or any other base structure's data. By inheriting, the
11 system 100 is creating a child class A 210. The child class A 210 represents the definition of the
12 object oriented based object A 205 and derives it from the non-object oriented C structure 200.
13 When an instance of the derived class A 210 is instantiated through static casting, the new object
14 will have full access to the non-object oriented information contained in the C structure 210. Upon
15 static casting, the designer can now use object oriented processes to access the non-object oriented
16 data. As a result, the programmer achieves the abstraction and object encapsulation benefits of an
17 object oriented system without adding to the size of the non-object oriented data. Thus, the new
18 object will have achieved full encapsulation of the non-object oriented data in a natural and easy to
19 maintain mechanism.

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21 Therefore, every time a programmer creates an object, instead of allocating new memory,
22 the programmer maps from the object oriented system onto the non-object oriented data. Now
23 the programmer can use the object oriented system to access the non-object oriented data.
24 Furthermore, this process is transparent to the user who does not know any other system besides
25 the object oriented system.

1 **Figure 3** illustrates the steps to mapping an object oriented object to an image in memory
2 occupied by a non-object oriented data model. Initially the system 100 determines if data should
3 be loaded in memory 120 (step 300). If the data should not be loaded, the system ends the
4 program (step 305), otherwise the data is loaded into the memory 120 (step 310). Next, the
5 programmer has to decide if they want to access the non-object oriented data in a mapped
6 structure (step 315). If the programmer does not want the data in a mapped structure, they can
7 perform other tasks (step 320). Otherwise, the programmer casts the last record of a particular
8 data element X in the non-object oriented structure to an object Y in the object oriented model
9 (step 325). Next the programmer accesses data element X using object Y's interface (step 330).
10 Now the system has achieved zero-sized mapping using inheritance. If the programmer is done, the
11 process is completed (step 335), otherwise the programmer performs other tasks (step 320).

12 Entire non-object oriented data models can be mapped to object oriented based data
13 models using the above technique. The object oriented based data models can in turn define many
14 new interfaces to access non-object oriented data without incurring any memory size on these new
15 objects. This technique preserves investment and applies object oriented based methods to not
16 only expand access, but also do it without incurring additional memory.

17 In the claims:

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